SPECIFICATION

Please replace the paragraph beginning at page 2, line 5, with the following rewritten paragraph:

--Other industries are also placing bandwidth demands on Internet service providers, and other data providers. For example, hospitals transmit images of X-rays and Computed Axial Tomography (CAT) [[CAT]] scans to remotely located physicians. Such transmissions require significant bandwidth to transmit the large data files in a reasonable amount of time. The need for more bandwidth is evidenced by user complaints of slow Internet access and dropped data links that are symptomatic of network overload.--

Please replace the paragraph beginning at page 6, line8, with the following rewritten paragraph:

--Also, because a UWB pulse is spread across an extremely wide frequency range, the power sampled at a single, or specific frequency is very low. For example, a UWB one-watt pulse of one nano-second duration spreads the one-watt over the entire frequency occupied by the UWB pulse. At any single frequency, such as at the carrier frequency of a Cable Television (CATV) [[CATV]] provider, the UWB pulse power present is one nano-watt (for a frequency band of 1GHz). This is calculated by dividing the power of the pulse (*i.e.*, 1 watt) by the frequency band (*i.e.*, 1 billion Hertz). This is well within the noise floor of any communications system and therefore does not interfere with the demodulation and recovery of the signals transmitted by the CATV provider. Generally, a multiplicity of UWB pulses are transmitted at relatively low power (when sampled at a single, or specific frequency), for example, at less than -30 power decibels to -60 power decibels, which reduces interference with conventional radio

frequencies. UWB pulses, however, transmitted through many wire media typically do not interfere with wireless radio frequency transmissions. Therefore, the power (sampled at a single frequency) of UWB pulses transmitted though wire media may range from about +30 dBm to about –140 dBm.--

Please replace the paragraph beginning at page 8, line 17, with the following rewritten paragraph:

--One feature of the present invention is that it provides a receiver with the capability to demodulate various amplitude-, phase-, and timing-based modulation schemes. According to one embodiment, the present invention uses a modified "Costas Loop." A typical, conventional Costas Loop, shown in FIG. 3, is used to generate a local carrier. An incoming signal may be expressed as $m(t)\cos(w_c t + \Theta_i)$ [[*m(t)* $\cos(\omega_c t + \theta_i)$]]. The incoming signal is split into two duplicate signals with one being expressed as a Sine wave and the other as a Cosine wave. The Sine and Cosine waves are each transmitted to mixers 2, 3. The mixers 2, 3 multiply the incoming signal by a local signal generated by a voltage controlled oscillator 4. The voltage-controlled oscillator (VCO) 4 generates a local signal expressed as $2\cos(w_c t + \Theta_0)$ [[$\cos(\omega_c t + \theta_o)$]]. Phase delay 5 creates the signal $2\sin(w_c t + \Theta_0)$ by shifting the phase of a copy of the generated signal by $\frac{\pi}{2}$. Mixers 2 and 3 then multiply the incoming signal $m(t)\cos(w_c t + \Theta_i)$ by the locally generated signals $2\cos(w_c t + \Theta_0)$ and $2\sin(w_c t + \Theta_0)$. ~~The voltage controlled oscillator (VCO) generates a local signal expressed as~~ ~~$\cos(\omega_c t + \theta_o)$~~~~. The Sine wave, however, is multiplied by a phase-delayed signal due to phase delay 5. A phase error may be expressed as~~ ~~$\theta_e = \theta_i - \theta_o$~~. The products are then transmitted to low-pass filters 6, 7. The

low-pass filters 6,7 may be used to attenuate a high frequency component of the product signals [[signal]] to yield phase error dependent outputs expressed as [[*m(t)* cosΠ_e and *m(t)* sinΠ_e]] $m(t)\cos(\Theta_e)$ and $m(t)\sin(\Theta_e)$ respectively. Phase error may be expressed as $\Theta_e = \Theta_i - \Theta_0$. --

Please replace the paragraph beginning at page 9, line 8, with the following rewritten paragraph:

--Again referring to FIG. 3, outputs from the low-pass filters 6 and 7 may be further multiplied to yield [[$m^2(t)$ sin 2Π_e]] $\frac{1}{2}m^2(t)\sin(2\Theta_e)$ using a mixer 8. Output from the mixer 8 is then transmitted to a narrow-band low-pass filter. Passing this output through a narrow-band low-pass filter results in an output that may be expressed as [[*k* sin 2✓e,]] $K\sin(2\Theta_e)$ where *k* is a direct current component of [[m^2(t)/2]] $\frac{1}{2}m^2(t)$. A signal expressed as [[*k* sin 2✓e,]] $K\sin(2\Theta_e)$, is applied to an input of the voltage controlled oscillator with quiescent frequency [[ω_c]] w_c. The input [[*k* sin 2✓e]] $K\sin(2\Theta_e)$ increases an output frequency which, in turn, reduces [[✓e]] the phase error Θ_e.--

Please replace the paragraph beginning at page 10, line 19, with the following rewritten paragraph:

--As shown in FIG. 4, an incoming signal is split into two signals 80(a) and 90(a). The incoming signal may be represented by a time-limited sinusoidal signal having a center frequency ω_c and a phase θ. In other words, the incoming signal is approximated by $\cos(\omega_c t + \theta)$ during an active signal duration. A local signal generator 40 generates a local

signal 100(b) that has the same frequency and a potentially different phase ϕ of the incoming signal. The local signal 100(b) may be characterized as $\cos(\omega_c t + \phi)$. The local signal 100(b) is filtered by a matched filter 110, and the filtered signal is split into two (2) duplicate signals. <u>Matched filter 110 may comprise a bandpass filter. Additionally, matched filter 110 may have a passband bandwidth of approximately 3 GHz</u>. One of the duplicate signals is multiplied by the incoming signal using a first mixer 10(a). The other duplicate signal is phase shifted by a phase delay element 30. Preferably, the phase delay element 30 is configured to impart a $\frac{\pi}{2}$ phase delay to the other duplicate signal of the local signal 100(b). Preferably, the phase delay element may be a 90-degree phase delay circuit or a 270-degree phase delay circuit. This results in a signal represented by $\sin(\omega_c t + \phi)$. This is a phase delayed signal. The phase delayed signal is multiplied by the incoming signal using a second mixer 10(b). An output signal 80(b) from the first mixer 10(a) may be expressed as $\cos(\omega_c t + \theta)\cos(\omega_c t + \phi)$, which is equivalent to $\frac{1}{2}\cos(\theta - \phi) + \frac{1}{2}\cos(2\omega_c t + \omega + \phi)$. --

Please replace the paragraph beginning at page 20, line 9, with the following rewritten paragraph:

--FIG. 8 illustrates a method of generating a difference signal according to one embodiment of the invention. After quantizing the first and second output signals, the first quantized <u>output</u> signal may be multiplied by the [[first]] <u>second</u> output signal, in step 230, and the [[second]] <u>first</u> output signal may be multiplied by the second <u>quantized</u> output signal, in step 232. The resulting signals may be transmitted to a summer. The summer may be used to calculate an algebraic difference between the resulting signals, in step 234. The algebraic

difference may be represented by a difference signal. The difference signal may then be filtered.--

Please replace the paragraph beginning at page 20, line 17, with the following rewritten paragraph:

--Fig. 9A illustrates a system 250 for [[modulating]] <u>demodulating</u> ultra-wideband signals according to one embodiment of the invention. The system 250 may include an incoming signal receiver 252, incoming signal approximator 254, local signal generator 256, first and second output signal generator 258, first and second output signal quantizer 260, difference signal generator 262, and error signal provider 264. An incoming signal may be received by the incoming signal receiver 252. The incoming signal may be an electromagnetic communication signal. The incoming signal may be, for example, a plurality of ultra-wideband pulses or a conventional carrier-wave signal.--

Please replace the paragraph beginning at page 23, line 1, with the following rewritten paragraph:

--The difference signal generator 262 receives quantized first and second output signals from the first and second output signal quantizer 260. The first quantized signal and the [[first]] <u>second</u> output signal may be multiplied by the first quantized signal and first output signal multiplier 276. The second quantized signal and the [[second]] <u>first</u> output signal may be multiplied by the second quantized signal and second output signal multiplier 278. Output from the first quantized signal and first output signal multiplier 276 and the second quantized signal and second output signal multiplier 278 may be transmitted to an algebraic difference calculator 280. The algebraic difference calculator 280 may be a summer that sums the first and second

quantized signals to determine a difference between the first and second quantized signals. The difference may be represented as a difference signal. The difference signal may then be transmitted to a difference signal filter 282. The difference signal filter 282 is preferably a low-pass filter.--